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December 12, 2011

VIA ELECTRONIC DELIVERY

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, SW
Room TWA325
Washington, DC 20554

**Re: Notice of *Ex Parte* Presentations
WT Docket No. 11-18; RM-11592**

Dear Ms. Dortch:

On December 8, Vulcan Wireless LLC ("Vulcan") representatives Scott Wills, Paul Nagle, Paul Kolodzy, and Michele Farquhar met with: (1) Edward Lazarus, FCC Chief of Staff, and Amy Levine, Special Counsel & Legal Advisor to Chairman Genachowski; (2) Louis Peraertz, Legal Advisor to Commissioner Clyburn; (3) Mark Stone, Chief of Staff for Commissioner Copps; and (4) Julius Knapp, Michael Ha, Walter Johnston, and Ira Keltz from the Office of Engineering and Technology to discuss the critical need for a condition on the AT&T-Qualcomm acquisition that would help restore a consolidated Lower 700 MHz band class.

Vulcan is the Lower 700 MHz A Block licensee for the Seattle-Tacoma-Bremerton, WA and Portland-Salem, OR-WA Economic Areas. Vulcan acquired these licenses for approximately \$113 million in Auction 73 (at more than \$1.30 per MHz/pop), the sixth highest amount spent on A Block licenses and the tenth highest amount among all Auction 73 bidders. Vulcan purchased the spectrum recognizing that the 700 MHz band's superior propagation characteristics would enable efficient and affordable service to consumers residing in and traveling through the urban and rural communities that comprise its markets. Vulcan has actively participated in efforts by Lower 700 MHz A Block licensees to address equipment availability and Channel 51 interference issues, and it joined, and has been an active member of, the 3GPP standards body. In addition, Vulcan will be filing its 700 MHz interim performance status report by January 13, 2012.

During the meetings, the Vulcan representatives discussed the concerns that are dramatically impeding A Block broadband deployment (as described in the attached presentation distributed at the meeting with Edward Lazarus and Amy Levine). They discussed a key condition that the Commission must impose before allowing the transfer of Qualcomm's 700 MHz spectrum to AT&T, or the transaction will further subvert FCC policy, decrease market competitiveness, and further delay the deployment of 4G networks.

They also discussed the following points:

- The Commission should only impose a single condition that restores the original Lower 700 MHz band plan, which would reconsolidate and unify the paired spectrum in the Lower 700 MHz band (*i.e.*, the A, B, and C Blocks);

- The Commission should promptly grant the transfer with this condition, as a reunified band will speed network deployment. Conversely, failure to address the fragmentation of the Lower 700 MHz band now will cause additional delay in network deployments and discourage participation by smaller operators in future spectrum auctions, thereby reducing the value of spectrum, discouraging competition, and subsequently driving up costs to consumers; and
- The Commission should provide AT&T with a sufficient amount time to comply with the condition by affording AT&T up to two years to fully comply with any such condition and ensure that all of its 700 MHz mobile handsets operate on the unified Lower 700 MHz band plan.

The representatives also discussed the results of a “real world” study, funded by a consortium of several Lower 700 MHz A Block licensees,¹ intended to prove or disprove the unsubstantiated claims previously submitted to the FCC and 3GPP by AT&T and Qualcomm, among others, regarding the need for establishing two separate band classes to govern only three spectrum blocks. As described in more detail in the attached presentation and in Vulcan’s November 25 *ex parte* in this proceeding, the findings of the study were as follows:

- The underlying assumptions and claims put forth in 3GPP proceedings rationalizing a separate Band Class 17 were incorrect or overstated;
- Different operators’ systems in the Lower 700 MHz B and C Blocks actually pose a threat of interference to each other that is greater than any threat that would be introduced from a unified Lower 700 MHz band class that includes the A Block;
- Neither the high power E Block transmissions nor Channel 51 transmissions present an interference threat to AT&T’s LTE devices, which currently receive and manage signal level disparities from within the B and C Blocks that are greater than those which would need to be accounted for by restoring the original Lower 700 MHz band plan;
- Concerns about reverse intermodulation distortion interference are unfounded, as commercially deployed AT&T devices did not experience any such interference; and
- The vague and exaggerated concerns regarding the potential increase in cost and/or size of devices necessary to operate on a reunified Lower 700 MHz band plan are without merit, as the cost of devices with such a condition will be virtually unchanged.

In addition, Vulcan explained how the proposed transaction has already negatively impacted other Lower 700 MHz spectrum holders. In November 2011, a leading AT&T 4G network vendor submitted a proposal to the 3GPP (seemingly endorsed by AT&T) to have other non-AT&T 700 MHz spectrum holders reduce the amount of their usable bandwidth to compensate for AT&T’s anticipated use of the D Block. This proposal was not revealed to the FCC in any filings by AT&T, Qualcomm, or any vendors supporting this proposed transaction. Designed solely to accommodate AT&T’s use of the D Block spectrum, this proposal would force non-AT&T spectrum holders to forfeit

¹ The consortium members include: Vulcan Wireless, King Street Wireless, Cavalier Wireless, Continuum 700, Cox Wireless, C Spire and MetroPCS.

their valuable spectrum rather than require AT&T to bear the full responsibility of setting aside its own guard band to accommodate its operations on the D Block.

The representatives also addressed several unsubstantiated claims made recently by AT&T and Qualcomm in this proceeding.² They reiterated that there are no technical or cost impediments to reconsolidating the Lower 700 MHz band classes. The attached materials and engineering analysis refute further the unsubstantiated AT&T and Qualcomm claims.

Pursuant to Section 1.1206(b) of the Commission's rules, I am filing this notice electronically in the above-referenced docket. Please contact me directly with any questions.

Respectfully submitted,

/s/ Michele C. Farquhar

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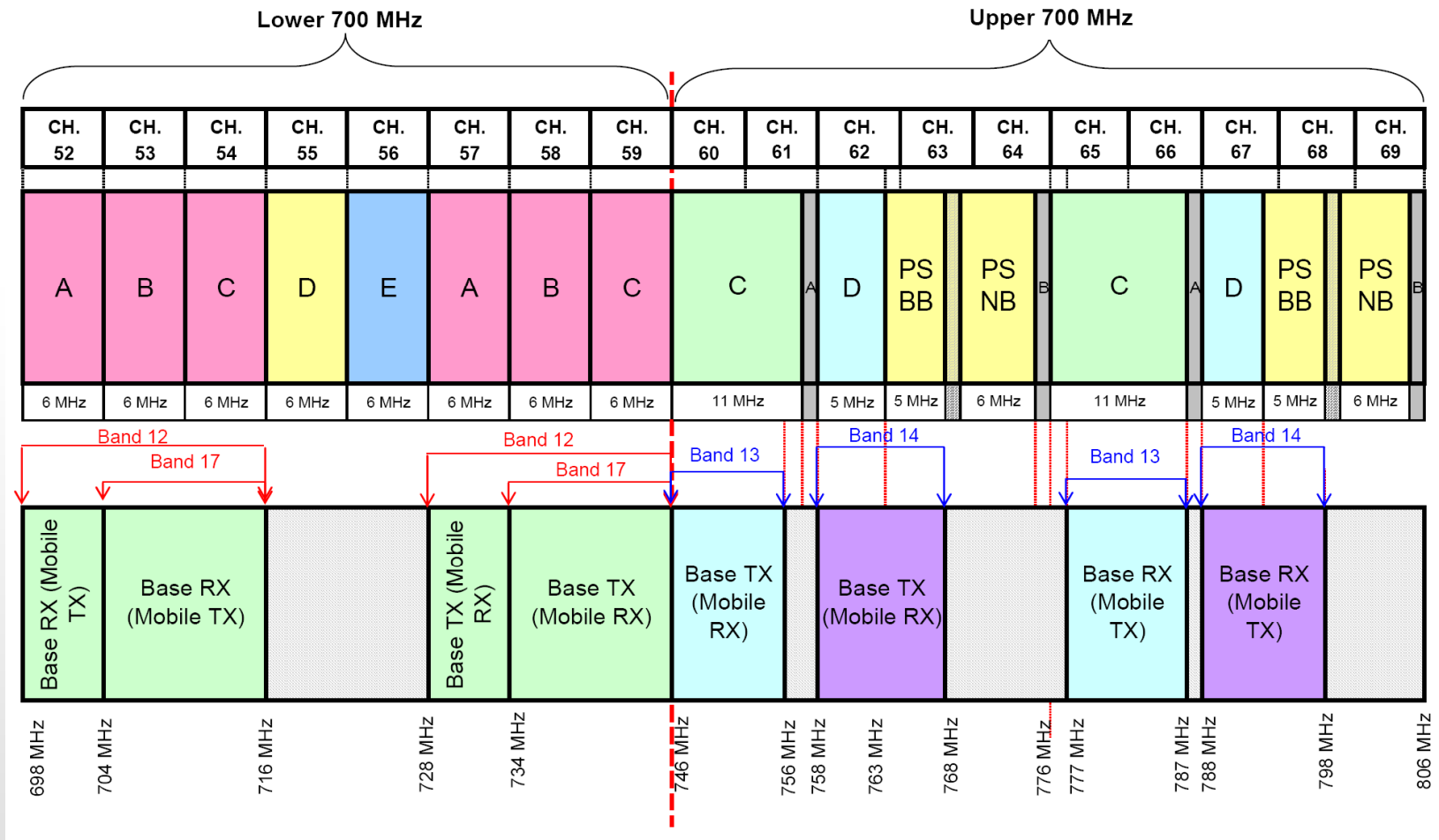
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Mark Stone
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Walter Johnston
Ira Keltz

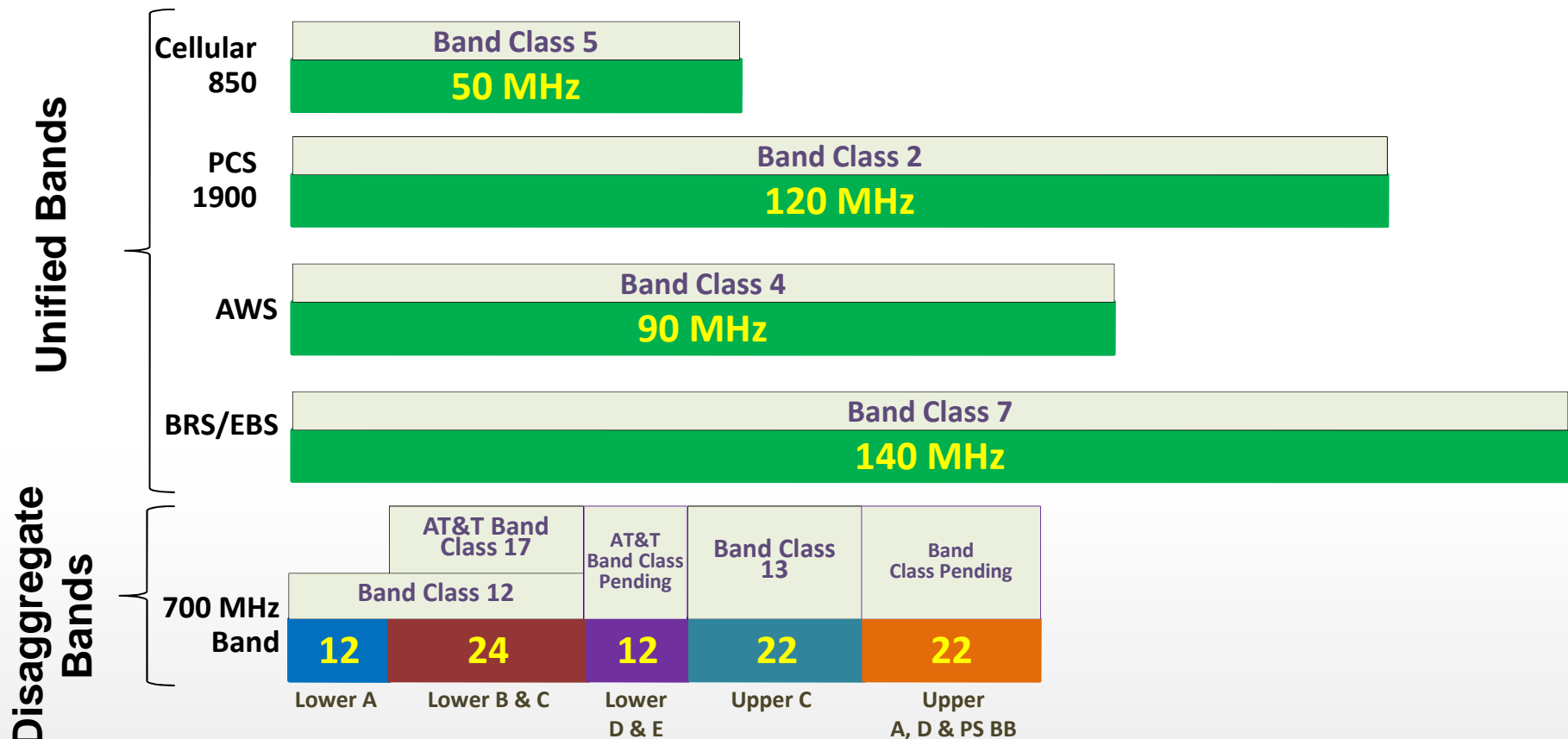
² See *Ex Parte* filing by Qualcomm Inc., WT Docket No. 11-18 (filed Dec. 6, 2011); *Ex Parte* filing by AT&T Services, Inc., WT Docket No. 11-18, RM-11592 (filed Dec. 7, 2011).

AT&T-Qualcomm and the Need for a Consolidated Lower 700 MHz Band Class

Vulcan Wireless
December 8, 2011

U.S. 700 MHz Band Plan & 3GPP Band Standards for LTE Equipment





- **With 700 MHz, the 3GPP process has been unduly influenced to force disaggregation**
- The unique use of 700 MHz frequencies exclusively in the US has given AT&T (a dominant 700 MHz spectrum holders) excessive influence, as there are no large international carriers using the same spectrum. This has led to unprecedented band class fragmentation and delays, slower ecosystem development and less consumer choice.

Activity Timeline for 700 MHz Band Class Pre- and Post- Auction 73

Dec 2007 (prior to auction) Only Band Class 12 is before 3GPP

March 2008 Auction closes

April 2008 Motorola submits paper to 3GPP proposing Band Class 17 – only covers B and C Blocks

June 2008 Ericsson questions reason for fracturing the band into separate band classes; Ericsson removes objections after AT&T supports Band Class 17

September 2008 3GPP ratifies Band Class 17 and Band Class 13 (Verizon's Upper C Block)

September 2009 A Block licensees petition FCC for device interoperability

December 2010 3GPP ratifies Band Class 12 with 1 MHz guard band

2011 (ongoing) VZ deploys 4G LTE covering more than 175 cities and more than 186 million Americans

2011 (ongoing) AT&T launches 4G LTE in 15 cities and to reach 70 million Americans by the end of 2011

2011 Band Class 12 licensees still await access to competitive handset ecosystem

November 2011 Ericsson requests that an additional 1 MHz of guard band be provided by Band Class 12 to protect spectrum being acquired from Qualcomm; AT&T speaks at 3GPP in favor of request

Post-merger, AT&T would control approximately 75% of the spectrum in the Lower 700 MHz band. While Verizon holds Lower 700 MHz A Block licenses, it has not provided any time frame for building out that spectrum. AT&T effectively dictates to the vendor community in the lower 700 MHz band.

The FCC Needs to Require a Simple Condition to Curtail Manipulation and Compensate for the Absence of the Traditional Balance of Market Forces in the Band Plan Process

- The 3GPP process is predicated on market force collaboration, but AT&T unfairly used its influence and monopsony power over the Lower 700 MHz vendor community to “carve up” the existing unified band plan, thereby orphaning A Block licensees by creating its own proprietary band class
- AT&T’s dominance of the band plan process thwarts FCC policies and efficiencies that benefit consumers, vendors, and licensees
- Requiring a reconsolidated band class will compensate for the lack of traditional market forces and rebalance the band plan process

AT&T Has Already Taken Steps to Modify Band Class 12 Which Could Render a Portion of Other Licensees' Spectrum Unusable, Undermining Its Own Declaration to the FCC

- AT&T's acquisition of the D & E Blocks directly impacts Band Class 12 operations
 - As recent as three weeks ago at 3GPP, AT&T spoke in favor of a proposal regarding base station operations that would require Band 12 licensees to set aside 1 MHz of their spectrum to go unused as guard band to support AT&T's D Block operations, rather having AT&T solely provide its own guard band.
 - **AT&T's Declaration to the FCC has already been breached:** "AT&T's deployment of D & E block base station should have little effect on future deployments of A, B, and C Block base stations by AT&T or any other licensee."
- This will further orphan Band 12 license holders, slow and/or eliminate 4G deployments and give undue power to AT&T in future spectrum auctions, inconsistent with FCC policy.

Extensive Study Demonstrates that There Are No Technical Impediments to Lower 700 MHz Interoperability

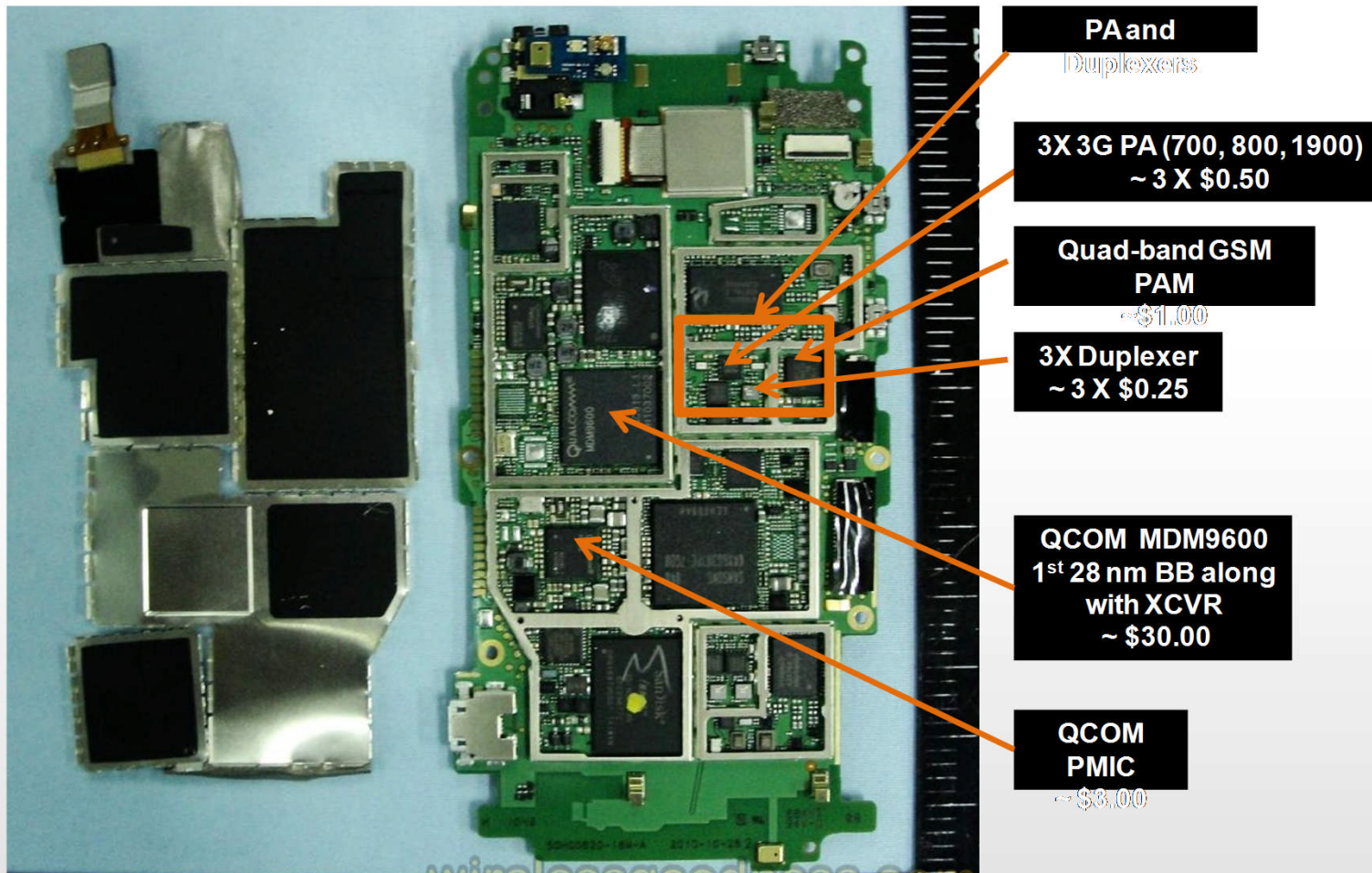
- A consortium of several 700 MHz A Block license holders* funded a “real world” study by conducting a variety of tests and collaborative engineering analyses/evaluations regarding the underlying assumptions originally put forth regarding the need for a separate Band Class 17 in the Lower 700 MHz band that has precluded interoperability
- The study included a combination of in-market field environmental measurements along with device lab bench testing of AT&T 4G devices
- The study included field measurements in Atlanta, a market with a high power E Block system (50 kW), AT&T Lower B and C Block LTE system, Verizon Upper C Block LTE system, a high power Channel 51 broadcaster and an LPTV broadcaster. Also included in the test were AT&T LTE 4G devices

*The consortium members include: Vulcan Wireless, King Street Wireless, Cavalier Wireless, Continuum 700, Cox Wireless, C Spire and MetroPCS

Summary of 700 MHz Study Findings

- Band Class 17 B and C Blocks already suffer greater interference threats from each other than what would be introduced from a unified Lower 700 MHz Band Class that includes the Lower A Block. Neither high power E Block transmissions nor Channel 51 transmissions create an increased interference threat; in fact, the interference threat is lower.
 - AT&T LTE devices currently receive and successfully manage greater levels of interference from within the B and C Blocks than need to be accounted for by unifying the Lower 700 MHz paired bands
 - Concerns and claims made about reverse intermodulation distortion interference are unfounded
- Unsubstantiated concerns and claims about the potential increase in cost or size of devices are inaccurate and misstated as testing shows the BOM costs will remain virtually unchanged.

Components that are required to enable a unified band plan are all < \$1 and, in quantity, have no cost impact.



Device Component Bill of Materials for HTC Thunderbolt: Device Performance indicates that no changes are required except to simply broaden the duplexer to cover Lower A, B and C Blocks.

Broadband Deployment, Innovation, and Competition Policies Have Been Circumvented

- Small, regional, and new entrant A Block licensees, not including Verizon Wireless, paid more than \$1 Billion in the 2008 auction.
- A fractured Lower 700 MHz band class has significantly delayed innovative A Block wireless broadband deployments and the development of equipment, stranding their substantial investment in the spectrum.
- The April 2011 FCC Workshop on Interoperability revealed that primarily business reasons, more so than technical reasons, drove 700 MHz band plan fragmentation.
- If AT&T is allowed to hide behind the claim that its mobile devices do not interoperate with other 700 MHz spectrum, then competition, consumer choice, and small carrier investment and jobs will suffer.
- A lack of interoperability also directly undercuts roaming and reduces 911 availability.
- Without FCC action now, before the Lower 700 MHz band becomes permanently fractured like public safety networks, the opportunity to correct the situation may become forever lost.

The Solution: Reconsolidated Lower 700 MHz Band Class, with Extended Transition Period

The FCC should adopt only a single condition on the AT&T-
Qualcomm transaction that will help reconsolidate and unify
the paired spectrum in the Lower 700 MHz band while
allowing AT&T to proceed with its current deployment plans

- *After the transaction closes, any mobile device offered by AT&T that operates on paired Lower 700 MHz band spectrum must operate on all Lower 700 MHz band paired spectrum. This condition only applies to new devices, beginning as early as 6 months after the transaction closes and fully implemented two years following the close of the transaction*

Benefits of the Proposed Condition

Narrowly tailored to address specific harms from the AT&T-Qualcomm transaction

Simple and straightforward

- Rebalance market forces that allow for fair competition.
- Allows AT&T to transition to this solution over time.
- No stranded investment because no impact on current handset sales.

A solution that will evolve as mobile wireless services evolve

- Solution that addresses known issues today and unanticipated issues of tomorrow.
- Does not force AT&T into a single configuration.
- Allows AT&T to innovate and develop new handsets just as in other mobile bands (which all have a uniform band class).
- Ensures that Band Class 12 licensees can get devices, and that roaming is technically possible across the Lower 700 MHz band.

Interference is not an impediment to interoperability

- The FCC workshop revealed that there is no technical barrier to interoperability.
- Extensive testing developed by 8 A Block operators demonstrated that there is no technical reason for separate band classes.

**Vulcan Wireless LLC Response to *Ex Parte* Filings from
Qualcomm (12/06/11) and AT&T (12/07/11)**

CORRECTING THE UNSUBSTANTIATED AT&T AND QUALCOMM CLAIMS:

**There Are No Technical or Cost Impediments to
Reconsolidating the Lower 700 MHz Band Classes**

Unsubstantiated Claim #1: The Lower A Block Coalition's field tests are invalid because they did not measure the signal of the DTV Channel 51 station closer than two kilometers from the Channel 51 transmitter. As a result, the study did not take measurements in the 12 square kilometer area within which the interference would be greatest.

Fact: Attached is an engineering analysis refuting claims that a problem may still exist because the Coalition study did not take measurements within 2 kilometers of the DTV Channel 51 transmitter. The analysis confirms that use of Band Class 17 is not required under any circumstances, and that Lower 700 MHz band devices integrating the A, B and C Blocks will operate normally near DTV Channel 51 towers.

Had AT&T and Qualcomm attempted to provide any data to support their claims, they would have found that the highest interference would not be directly underneath the Channel 51 transmitter. With respect to broadcast systems, the highest signal levels are not below the antenna or generally anywhere close to the antenna of a high power transmission system. Deployments of large, high-power transmission systems (such as those used for high-power DTV stations) use antennas with small angular extent in elevation. To cover large areas (*e.g.*, what a DTV transmission system would be designed to do), a system should (a) use antennas with small extent in elevation, and (b) point the antenna close to the horizon. In other words, pointing an antenna down is not optimal when the goal is to cover large areas, so that the power levels and greatest potential interference will not be within the 12 square kilometer area of a Channel 51 transmitter.

Engineers that deploy cellular systems in highly populated areas do point the antennas down somewhat because of the desire to enable frequency reuse. But cellular systems are not broadcast systems, and to the extent a cellular transmitter were to be located on a tall tower, the cellular system would be designed to handle the large number of users and thus the signal strength to the cell phone would be higher.

Unsubstantiated Claim #2: The field tests are invalid because they only measured one DTV Channel 51 station.

Fact: With at most one DTV Channel 51 license per city, there were not additional towers to test in Atlanta. Moreover, most DTV towers are on mountaintops or located in relatively remote rural areas to provide the structure necessary to support the antenna and provide the desired coverage.

Unsubstantiated Claim #3: The field tests are invalid because they studied a test deployment of four transmitters in Atlanta (even though FLO TV operated 13 transmitters to serve the Atlanta market), which produced the much higher level of signal strength required of a commercial service.

Vulcan Wireless LLC Response to *Ex Parte* Filings from Qualcomm (12/06/11) and AT&T (12/07/11)

Fact: The real-world Atlanta study attempted to find areas of high signal strength under a worst-case analysis. Therefore, the attempted focus on the number of transmission facilities is both irrelevant and misleading.

The E Block transmitters tested were at the maximum authorized power of 50 kW and represent an accurate real-world view of signal strength near a high-power broadcast facility. The test results capture signal intensity near the tower. A larger number of towers would improve coverage in weak signal areas, but would not add to the strong signal in the near vicinity of a broadcast tower. From this perspective, the number of towers in the city is immaterial. Slide 11 from Vulcan's November 25 *ex parte* in this proceeding included the transmit ERPs for each site.

The physics would not change if we were to test the now-defunct MediaFLO signal transmitted from Lower 700 MHz D Block towers. For the stated power level and similar antenna patterns and tower heights, the same signal levels would be measured.

It is also worth noting that Qualcomm made this claim without providing any supporting data or references to such data. As the prior system operator of over 500 broadcast towers, surely Qualcomm would have some data to submit to the record.

Unsubstantiated Claim #4: *Vulcan minimizes the interference to Band Class 12 devices from E Block transmissions by claiming that it is equivalent to interference between the B Block and C Block. Contrary to those findings, AT&T believes that the signal level from E Block transmissions (and corresponding interference) will be higher than assumed by Vulcan, a belief that appears to be borne out by Qualcomm's suggestion that Vulcan should have used more than four transmitters transmitting at 50 kW to measure E Block signal levels.*

Fact: The laws of physics cannot be altered, regardless of AT&T's mistaken beliefs.

Field measurements of live E Block transmitters radiating 50 kW of power demonstrated that the ratio of signal levels between the E Block and AT&T's LTE signals are well within the device capability measured in the lab. No special coordination or RF design consideration is required to ensure that LTE devices operate normally in the vicinity of high-power E Block towers. Testing a larger number of towers would not change the physics involved in propagation near a site – the signal levels from multiple towers are not additive in the near vicinity of the transmitter; the nearest broadcast transmitter dominates. The field measurements affirm the theoretical analyses submitted in 2010¹ which illustrated how LTE system design practices would eliminate any instances of interference. Since the worst case interference would occur within a few blocks of the transmitter in an outdoor environment, such a small area of interference could be managed through LTE base station selection. A stronger LTE downlink signal protects against any threat of device receiver blocking. The analyses used the worst case of 3GPP minimum performance

¹ See *Ex Parte* filing by 4G Coalition, WT Docket No. 06-150, PS Docket No. 06-229, GN Docket No. 09-51, RM Docket No. 11592, "700 MHz Band Analysis" by Wireless Strategy, LLC (May 25, 2010); see also *Ex Parte* filing by the Coalition for 4G in America, WT Docket No. 06-150, PS Docket No. 06-229, GN Docket No. 09-51, "Lower 700 MHz Interference Management" by Wireless Strategy, LLC (Sept. 20, 2010).

**Vulcan Wireless LLC Response to *Ex Parte* Filings from
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levels to demonstrate that the claimed issue was manageable. The commercial devices performed much, much better than the 3GPP minimum levels, eliminating any doubt regarding interference-free operation.

Unsubstantiated Claim #5: The Lower A Block Coalition's Lower 700 MHz E Block field test results are invalid because the sites tested were the E Block DISH broadcast sites and not the D Block MediaFLO sites.

Fact: The Lower E Block broadcast sites tested were transmitting at the maximum allowed ERP of 50 kW. Any interference issues would be encountered within a few blocks of the transmitter – the number of broadcast locations in a city is immaterial. And Qualcomm's assertions that the RF environment would be different for a FLO site are simply incorrect, provided that Qualcomm complied with the FCC regulatory limits for ERP in their D Block operations. Moreover, the engineering team considered E Block measurements to be more appropriate in documenting a potential E Block interference threat, rather than measuring D Block transmissions.

Qualcomm's suggestion that the study should have collected test data on the MediaFLO sites is also odd. Since the MediaFLO system in Atlanta was dismantled some months ago, it would be difficult to collect data on a non-existent system. Indeed, the DISH broadcast sites are scheduled for dismantling in the coming months. As Qualcomm has attested, mobile broadcast video is not a viable business case. Therefore, a high-power broadcast system in the E Block does not seem likely to exist at all, much less to create harmful interference.

Unsubstantiated Claim #6: From the measurements on the LPTV station with transmit power of 10 kW, the Vulcan study found received power levels of -21 dBm and noted that it did not believe that this would cause problems. It should be noted, however, that if the transmit power at that station was 1 MW (i.e., 20 dB higher), the received power would be -1 dBm and from Vulcan's analysis this could introduce interference.

Fact: AT&T's assumption is flawed. A DTV transmitter mounted on a 138 m tower would not transmit at the full 1 MW power level, but at reduced power, as evidenced by the FCC station records for similar configurations.

The typical power level for this lower tower height is 100 kW, a 10 dB reduction. Using AT&T's approach, this makes the maximum observed signal level near the tower -11 dBm. Adjusting for the difference in antenna gain from the test setup (+3 dBi) to a typical LTE device (-5 dBi), the signal level at the device antenna port would become -19 dBm. This signal level is well below that required to generate intermodulation (IM) equal to the device noise floor. Reverse power amplifier (PA) IM near DTV 51 stations is not a valid interference threat, even under the worst case conditions of a very weak LTE downlink signal and maximum device transmit power when next to the DTV tower.

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Qualcomm (12/06/11) and AT&T (12/07/11)**

***Unsubstantiated Claim #7:** The study conducts its testing using Band Class 17 devices, rather than Band Class 12 devices. Vulcan seems to presume that Band Class 12 filter characteristics would mimic the characteristics of Band Class 17 filters, a presumption that may be unfounded. Further, Vulcan limited its testing to two devices, an insufficient sample to extrapolate to the performance of all Band Class 17/Band Class 12 devices.*

Fact: The lab tests indicate that the Band Class 17 versus Band Class 12 RF filter would play no role in defining the reverse PA IM interference strength, as suspected by Ericsson in 2008.²

The lab tests included reverse PA IM tests with the interferer placed in the Lower A Block to emulate a Band Class 12 RF filter present during the IM test. The generated IM products were of the same amplitude as the case where the interferer was placed within Channel 51, simply shifted lower in frequency given the different mix of frequencies.

***Unsubstantiated Claim #8:** The study does not address other interference issues, such as high-powered broadcast on Channel 51 into A Block base stations and Band Class 12 device interference into TV receivers operating on Channel 51.*

Fact: The potential for Channel 51 to cause interference to A Block base stations is not a device filter issue and played no role in defining Band Class 17, as noted by several base station vendors in the 2008 3GPP discussions. This is a deployment issue to be managed by the Lower A Block licensees. And Band Class 12 device interference into TV receivers is a claim that has never been substantiated.

The Band Class 17 proponents have submitted no theoretical analysis or test data suggesting that Band Class 12 devices cause interference, nor have they submitted evidence quantifying any benefit provided by a Band Class 17 RF filter in reducing emissions into Channel 51. The 3GPP specification for Band Class 12 device emissions exceeds the FCC guidelines by 10 dB or more. With no evidence suggesting that a problem may exist, this claim should not be taken seriously as a reason for supporting Band Class 17.

***Unsubstantiated Claim #9:** Chipsets are an issue.*

Fact: Chipsets are not an issue.

² 3GPP TSG RAN WG4 R4-081356, "On the introduction of band 15" [now Band Class 17], Ericsson, June 2008, p. 5, "[T]he extra attenuation of the TX duplexer is still uncertain. The isolation has to be provided on the 'wrong' side of the TX duplexer filter that needs to provide high attenuation in the RX band on the other side of the passband." In other words, RF filters typically do not provide stringent attenuation for frequencies outside of the transmit band that are not in the direction of the receive band. The Band Class 17 rejection of Channel 51 does not appear to be significant, as suggested by the lab IM testing.

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According to Qualcomm, its chips can support up to five frequency bands – two below 1 GHz and three above 1 GHz. By supporting Band Class 12 instead of Band Class 17, only one low frequency band is used for 700 MHz, leaving one low-frequency band for cellular. New chipsets would need to be developed, however, to support Band Class 12, a cellular band, plus the Lower 700 MHz D and E Block spectrum in one device. This statement similarly applies to the current Band 17 situation – new chipsets are required to support Band Class 17, cellular, and Lower 700 MHz D and E spectrum in one device.

Qualcomm also confirms that it is “actively exploring technically whether it can develop a chip that would support the two Lower 700 MHz band classes plus the cellular band, although it does not have such a solution today.” This is precisely why a condition to unify and reconsolidate the Lower 700 MHz Band classes is necessary. The existence of two band classes in the Lower 700 MHz Band has significantly hampered and, as of today, completely prevented the deployment of LTE networks on the Lower A Block. Since the interference claims have been demonstrated to lack merit, Band Class 17 is not needed. Consolidation to Band Class 12 would permit devices to use the existing chipset designs.

***Unsubstantiated Claim #10:** The 3GPP process will not be abused. According to Qualcomm, the contributions from Ericsson and Alcatel-Lucent to the 3GPP TGS-RAN WG4 (“WG4”) standards group were presented, but not agreed to, by WG4 because a Lower C Block licensee objected. Qualcomm also notes that unanimous consent is generally required for approval of any contribution to WG4 and that no party can use a 3GPP submission to force the Lower C Block licensees to relinquish any spectrum or to accept harmful interference to their operations without their approval.*

Fact: It is unrefuted that there have already been two recent attempts to change the Lower 700 MHz band classes, and there is nothing in the record to suggest that AT&T or other parties will refrain from making a similar contribution to 3GPP in the future. Moreover, if the AT&T-Qualcomm transaction is approved, AT&T will have an even greater influence over the 3GPP process and an even greater incentive to pass this proposal to effectively take away usable spectrum from Lower 700 MHz band licensees.

Also, while it is true that unanimous consent is “generally required for approval” of many 3GPP proposals, a sophisticated 3GPP participant like Qualcomm knows that procedures are in place to approve proposals over the objections of the minority of participants. For example, Annex G of the April 2010 3GPP Working Procedures outlines the procedure for passing “working agreements”:

'Working agreements' are tentative decisions reached by 3GPP groups in order to make progress on matters where consensus . . . cannot be reached. [They are] intended to be used in situations where there is a clear majority in favour of one approach, but a small minority has sustained opposition to that approach.

http://www.3gpp.org/ftp/Information/Working_Procedures/3GPP_WP.htm#Annex_G.

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Engineering Analysis

Qualcomm recently questioned the validity of the DTV 51 field test data collected in Atlanta by a Coalition of Lower 700 MHz A Block licensees, contending that some DTV 51 towers are located on tall buildings in cities and may generate stronger ground-level signals near the tower.³ The Atlanta measurements were restricted by the difficult terrain surrounding the mountaintop DTV 51 site north of Atlanta.

Qualcomm's interference concern is reverse power amplifier (PA) intermodulation (IM). Reverse PA IM would theoretically be generated by Lower 700 MHz devices closely approaching a DTV 51 tower. If the device transmission is strong and the DTV 51 signal is strong, then the high DTV interfering signal level may mix with the device's own transmission and create IM. For such IM interference to impact the device's receive frequencies, the device must transmit at maximum power near the upper portion of the Lower C Block while simultaneously receiving in the lowest portion of the Lower B Block. Note that this requires operation by a single licensee across both the Lower B and C Blocks; markets where the B and C Blocks are used by different operators would never experience DTV 51 interference from IM.

The lab measurement data further demonstrated that the device transmission must be at maximum power and the DTV 51 signal at the antenna must be near 0 dBm for a low level of IM to be measurable. While such a "perfect storm" is unlikely to exist in any real-world deployment, we provide additional engineering analysis to assuage Qualcomm's concerns.

The FCC's "Spectrum Dashboard" web application provides licensee information and constructed tower locations for the Digital Television spectrum and other spectrum bands.⁴ A review of the database for DTV Channel 51 reveals 29 active licenses. One license in Medical Lake, Washington, is not constructed. Of the remaining 28 licenses, 15 towers fall within areas where AT&T owns none or one of the Lower 700 MHz paired blocks, automatically excluding any possibility of IM interference as noted above. The detailed list of DTV Channel 51 stations in the United States is provided in Table 1 below.

³ Qualcomm ex parte, December 6, 2011, p. 1.

⁴ <http://reboot.fcc.gov/spectrumdashboard/searchAdvanced.seam>

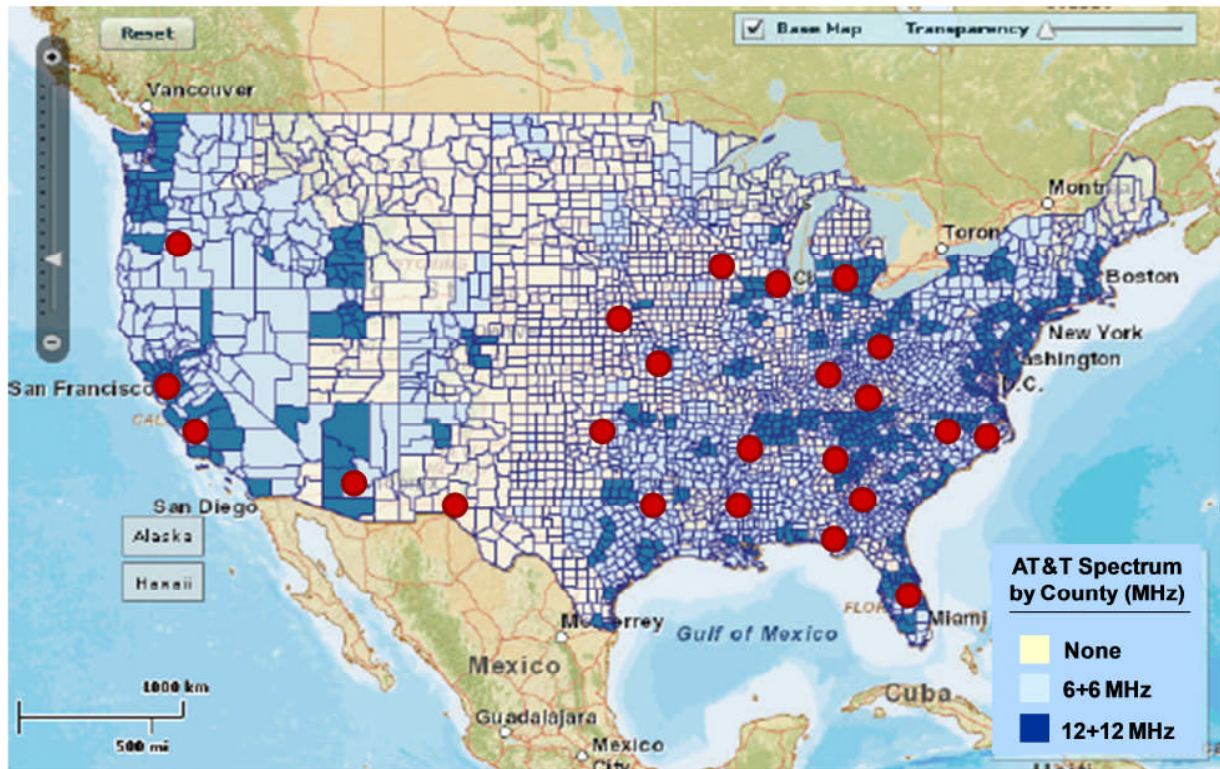
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| Number | Callsign | City | State | HAAT (m) | ERP (kW) | Latitude | Longitude | Proximity | AT&T Blocks |
|--------|----------|---------------------|-------|----------|----------|-------------|-----------|----------------|-------------|
| 1 | KPPX-TV | Tolleson | AZ | 536 | 1000 | 33.33416667 | 112.06056 | Mountaintop | Two |
| 2 | KCEC | Denver | CO | 232.5 | 900 | 39.73277778 | 105.23556 | Mountaintop | Two |
| 3 | WWJX | Jackson | MS | 150 | 20 | 32.05361111 | 90.339722 | Rural | Two |
| 4 | WTAE | Pittsburgh | PA | 273 | 1000 | 40.28027778 | 79.803056 | Rural | Two |
| 5 | KXLA | Rancho Palos Verdes | CA | 937 | 1000 | 34.22647222 | 118.06603 | Mountaintop | One |
| 6 | KGAN | Cedar Rapids | IA | 585 | 850 | 42.31638889 | 91.858333 | Rural | None |
| 7 | WPXX | Memphis | TN | 298 | 1000 | 35.21138889 | 89.815 | City | One |
| 8 | KSBI | Oklahoma City | OK | 457.9 | 1000 | 35.59777778 | 97.489444 | City | One |
| 9 | KTFN | El Paso | TX | 525.3 | 70 | 31.805 | 106.48306 | Rural | Two |
| 10 | WPWR | Gary | IN | 523 | 1000 | 41.87888889 | 87.636111 | City | One |
| 11 | WLAJ | Lansing | MI | 300 | 900 | 42.42027778 | 84.523611 | Rural | Two |
| 12 | WMYO | Salem | IN | 390.4 | 1000 | 38.35 | 85.849167 | Rural hilltop | Two |
| 13 | WPXA | Rome | GA | 622 | 1000 | 34.31333333 | 84.648611 | Mountaintop | One |
| 14 | WEPX | Greenville | NC | 154 | 143 | 35.4025 | 77.419444 | Rural | One |
| 15 | KPXE | Kansas City | MO | 339 | 1000 | 39.02222222 | 94.513611 | City | Two |
| 16 | KCEB | Longview | TX | 379 | 500 | 32.26 | 94.950556 | Rural | One |
| 17 | KDTV | San Francisco | CA | 701 | 476.3 | 37.49916667 | 121.87111 | Mountaintop | Two |
| 18 | KFXL | Lincoln | NE | 125 | 14 | 40.85277778 | 96.676667 | City | None |
| 19 | WAGV | Harlan | KY | 577 | 550 | 36.8 | 83.376667 | Mountaintop | None |
| 20 | WJAR | Providence | RI | 306 | 1000 | 41.865 | 71.2875 | Rural | Two |
| 21 | WNJN | Montclair | NJ | 233 | 200 | 40.86472222 | 74.200833 | City | Two |
| 22 | WSST | Cordele | GA | 110 | 91 | 31.89305556 | 83.805 | Rural | One |
| 23 | KOHD | Bend | OR | 205.7 | 84.1 | 44.07794444 | 121.33247 | City (hilltop) | One |
| 24 | WHLV | Cocoa | FL | 494 | 1000 | 28.58666667 | 81.082778 | Rural | Two |
| 25 | WFMY | Greensboro | NC | 568.8 | 1000 | 35.87027778 | 79.840278 | Rural | One |
| 26 | WKEF | Dayton | OH | 351 | 515 | 39.72444444 | 84.255 | City | Two |
| 27 | WBIF | Marianna | FL | 254 | 50 | 30.51166667 | 85.488056 | Rural | One |
| 28 | | Medical Lake | WA | | | 0 | 0 | Not on air | |
| 29 | | Carolina | PR | | | 18.27888889 | 65.853333 | | One |

Table 1: Nationwide DTV Channel 51 Towers

As noted in Table 1, only three of the DTV Ch 51 towers built where AT&T owns both the Lower B and C Blocks are located in cities where strong signals may reach the LTE coverage area. Figure 1 below reflects the location of Channel 51 towers overlaid on AT&T spectrum ownership, per the FCC Spectrum Dashboard.

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● Active Channel 51 Station

Figure 1: Nationwide DTV Channel 51 Towers and Lower 700 MHz AT&T Spectrum Position

The three towers constructed near cities and falling within areas where AT&T owns both the Lower B and C licenses are shown in Figures 2 through 4. Even within cities, the immediate vicinity of the tower is relatively clear of areas where subscribers would travel. Given the immense tower height of the broadcast towers (in excess of 230 meters), significant ground clearance is necessary to ensure tower stability and safety. LTE subscribers are unlikely to approach within a few hundred meters of a broadcast tower.

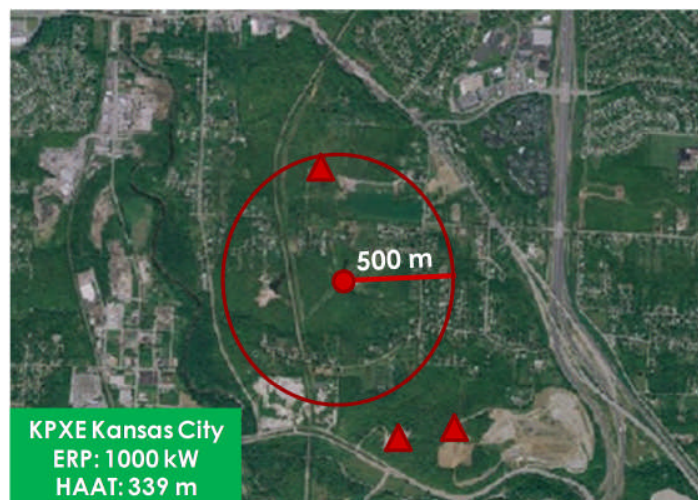


Figure 2: KPXE Kansas City DTV Channel 51 Tower

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Figure 3: Montclair, NJ DTV Channel 51 Tower



Figure 4: Dayton DTV Channel 51 Tower

Moreover, the broadcast TV antenna pattern is designed to focus energy on the horizon to maximize television coverage range. The energy directed toward the ground near the tower is considerably less than the main beam energy. Figure 5 shows the vertical radiation pattern for a typical broadcast television antenna, illustrating the reduction of energy below the horizon. At five hundred meters distance from the tower base, the angle below horizontal is in excess of 25 degrees, translating to a reduction in antenna gain of 17 dB or more. The broadcast television antenna pattern significantly reduces the signal strength at ground level. The ground-level energy near the broadcast tower closely resembles the signal strength near cellular-like base stations with lower antenna mounting heights.

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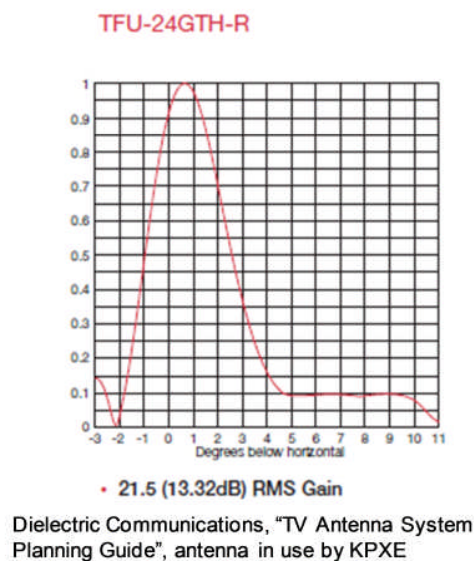


Figure 5: DTV Antenna Vertical Radiation Pattern

Assuming free space path loss and a minimum distance from the DTV antenna of 400 meters, the maximum signal level near the DTV tower may be derived as shown in Table 2.

| | | |
|---------------------------------------|-------|--------|
| DTV 51 ERP | 90 | dBm |
| Antenna discrimination | -17 | dB |
| Distance to LTE device | 400 | meters |
| Free Space Path Loss to device | 81.3 | dB |
| Body/clutter losses | 10 | dB |
| Maximum signal at device | -18.3 | dBm |

Table 2: Maximum Possible Theoretical DTV Signal Level

The perfect storm of conditions which must occur simultaneously for any IM interference to exist include:

- LTE device is in line-of-sight of the DTV tower with minimal path loss (a few hundred meters)
- Operator has deployed a 10 MHz LTE channel in the market
- Nearest LTE base station is far away such that the desired downlink signal, on the ground outdoors, is very low⁵
- Device is transmitting within the upper 500 kHz of the LTE channel at maximum power

⁵ A low LTE signal strength outdoors is highly improbable in a city because most operators attempt to cover inside of buildings. As a consequence, the signal level outdoors must be much stronger in order to penetrate the building.

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- Device is receiving the low-power downlink signal within the lowest 500 kHz of the LTE channel

With all of these conditions active in the laboratory testing, LTE devices demonstrated normal operation in the presence of interfering signals ***stronger than the theoretical maximum*** of Table 2 above.

Thus, the interference mechanism of concern to Qualcomm ***would not exist in a real-world system employing Band Class 12 devices.***

Nevertheless, if there were some scenario possible such that IM interference might have resulted, there are six engineering solutions available which would have independently resolved any concerns near these three DTV locations. The six solutions are:

1. Increase downlink signal strength near the DTV tower – one new LTE site would suffice.
2. Deploy 5 MHz LTE channels on the LTE site closest to the DTV tower. The two 5 MHz channels (Lower B and C) would ensure the device does not create self-IM by automatically managing the transmit/receive frequency pairings.
3. Implement a base station scheduler rule that assigns maximum-power device transmissions below the upper edge of the LTE channel, avoiding IM on the receive frequencies.
4. Implement a scheduler rule that avoids assigning receive frequencies in the lowest 500 kHz to devices transmitting at maximum power at the upper edge of the channel.
5. Relocate problematic Channel 51 stations to lower channels.
6. Improve device PA third order intercept performance to withstand stronger nearby signals (commercial devices already do this, thus no mitigation is required).

In conclusion, laboratory testing demonstrated that commercial devices handle the real-world DTV signal levels which may be encountered. Should any minor problems be detected within a few hundred meters of the DTV towers located in city areas, six valid engineering approaches would each, independently, completely eliminate any IM interference. Lower 700 MHz devices do not require the Band Class 17 filter to provide normal operation near DTV 51 towers.